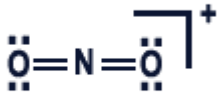
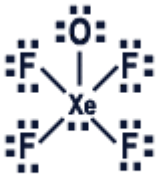
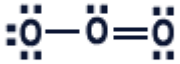
Question 1
12 Points

Draw the Lewis Dot Structure for each of the following molecules?

NO_2^+ 	SF_4 
XeF_4O 	BH_3 

Question 2
8 Points

Ozone, O_3, has two resonance structures. Draw them?

Structure 1	Structure 2
	

What is the O-O Bond Order in Ozone? 1.5

Question 3
4 Points

Which of the following will lead to a reaction that is very highly exothermic.
(Circle the correct one)

a. Weak bonds broken in the reactants + strong bonds formed in the products.

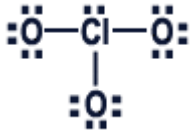
b. Strong bonds broken in the reactants + strong bonds formed in the products.

c. Strong bonds broken in the reactants + weak bonds formed in the products.

d. Weak bonds broken in the reactants + weak bonds formed in the products.

Question 4
10 Points

The questions below relate to the following Lewis Dot Structure:



a. What is the formal charge on the chlorine atom? +2

b. What is the formal charge on the oxygen atoms? -1

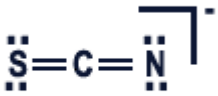
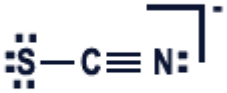
c. What is the overall charge on the molecule? -1

d. How might you go about reducing the formal charges on the atoms of this molecule?
By making two Cl:O double bonds, this would make Cl have a formal charge of 0, two of the oxygen's 0 and the third oxygen -1

e. Why would you be reluctant to do this?
Halides in general do not form multiple bonds … (CNOPS)

Question 5
13 Points

The molecule SCN^-, in which carbon is the central atom has three possible resonance structures. Draw them?

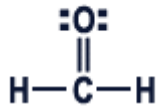
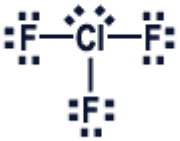
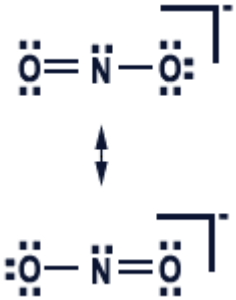
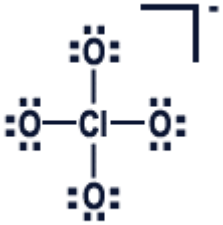
Structure 1	Structure 2
	
Structure 3	
	

a. One of the resonance structures is not reasonable and may be eliminated. Which one can be eliminated? Circle the structure number.

b. Given the following average bond energies in $kJ.mol^{-1}$ for C:N bonds
C-N 293 C=N 615 C≡N 891
What would be your estimate of the CN bond energy in SCN^- In the 700's

Question 6
14 Points

The questions that follow relate to the following Lewis Dot Structures.

1	2	3
		
4	**5**	**6**
		

a. What is the Electron Pair Geometry Of:

1 Trigonal planar

4 Trigonal planar

5 Tetrahedral

b. What is the Molecular Geometry of:

2 See-saw

3 T-shaped

6 Linear

c. Which (if any) of the molecules are non-polar

5 and 6

Question 7
4 Points

A hypothetical molecule AX_4 molecule if found to be very soluble in carbon tetrachloride (CCl_4) and very insoluble in dichloromethane (CH_2Cl_2).

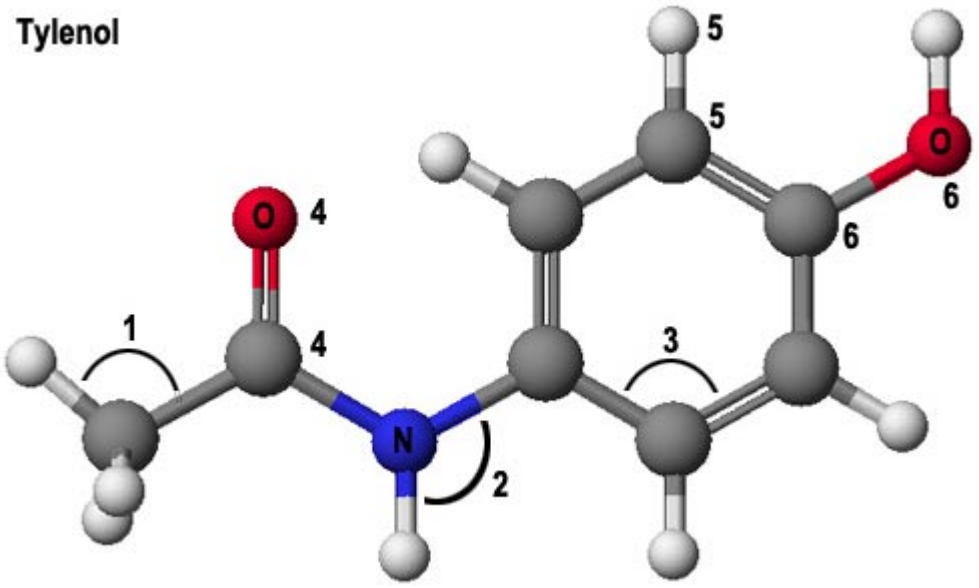
AX_4 is probably Polar Nonpolar

Briefly justify your choice?

CCl_4 is a nonpolar and since AX_4 is very soluble in it is most likely nonpolar as well.

Question 8
18 Points

The molecular geometry of Tylenol is depicted below:



a. Give the bond angles about 1, 2 and 3.

1. 109 2. 109 3. 120

b. The sigma bond between the carbon atom labeled 4 and the oxygen atom labeled 4 is due to the overlap of what 2 orbitals

C: sp^2 O: sp^2

c. The sigma bond between the carbon atom labeled 5 and the hydrogen atom labeled 5 is due to the overlap of what 2 orbitals

C: sp^2 H: 1s

d. The sigma bond between the carbon atom labeled 6 and the oxygen atom labeled 6 is due to the overlap of what 2 orbitals

C: sp^2 O: sp^3

Question 9
4 Points

Covalent molecules with a period 3 or greater element in the center can accommodate more than eight electrons. Why is this?

Those pesky unfilled d orbitals!

Question 10
6 Points

a. Consider the depiction of a surfactant molecule. The long part is a hydrophobic (nonpolar) hydrocarbon chain and the "head group" is polar. Sketch how these molecules would form a micelle when dissolved in methanol, CH_3OH.

Looking for a sphere in which the heads of the molecule are on the outside and the tails are all inside. CH_3OH is a polar solvent.

b. Which of the following would you expect to dissolve extensively in water? Circle all that apply.

$CHCl_3$ CH_2Cl_2 $CHCl_3$ CCl_4 I_2

Question 11
7 Points

Give the correct formula for each of the following ionic compounds.

a. Magnesium sulfite $MgSO_3$

b. Iron(III) dichromate $Fe_2(Cr_2O_7)_3$

c. Cobalt(II) chromate $CoCrO_4$

d. Potassium permanganate $KMnO_4$

e. Sodium sulfate Na_2SO_4

f. Aluminum nitrite $Al(NO_2)_3$

g. Ammonium perchlorate NH_4ClO_4